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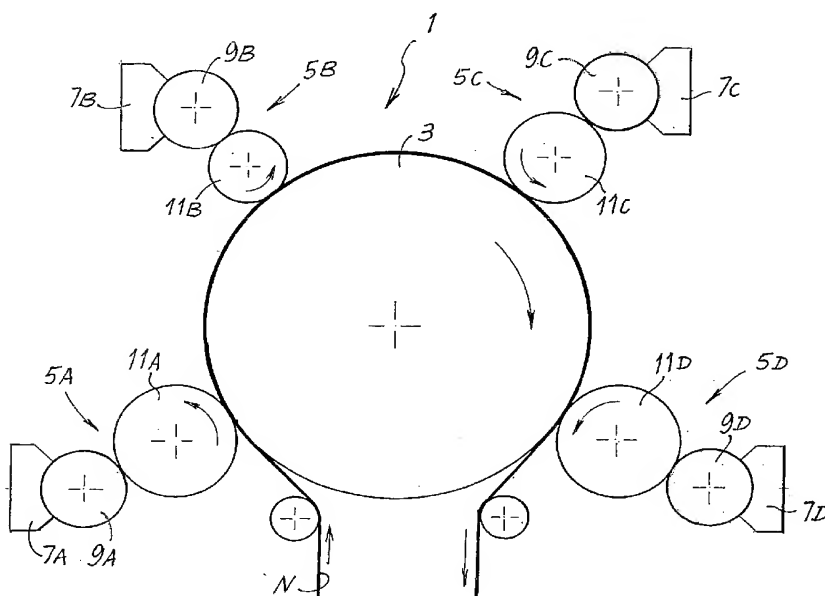
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(54) **Printing unit for decorating a web material and pack of decorated web material**

(57) There is described a printing unit for decorating a continuous web material, comprising a plurality of plate rollers (11A-11 D) disposed in series along a path of the web material, so that said web material is decorated with a print obtained by the combination of designs printed by said plate rollers. At least some of the plate rollers have

print plates with print extensions of different lengths from one another, equal to multiples of a predetermined longitudinal dimension and each of the plates has a plurality of designs of a length equal to said longitudinal dimension. Each print plate is provided with at least one series of designs different from one another and the designs of the plates differ from one another at least in part.

Fig.1



Description

Technical field

[0001] The present invention relates to improvements to devices for printing and decorating continuous web materials, in particular but not exclusively webs of tissue paper for producing rolls of toilet paper, rolls of kitchen towel, paper napkins, facial tissues or the like.

State of the art

[0002] In the production of disposable tissue paper articles, such as napkins or handkerchiefs, and also in the production of toilet paper, kitchen towel or the like, printing is frequently used to decorate the web material, possibly in combination with embossing. In the specific case of products in roll form printing is typically a continuous printing, for example constituted by one or more colored and variously decorated strips, which extend for the entire length of the web material wound in each single roll. In some cases, the rolls of tissue paper are decorated with repetitive patterns which are repeated with a specific pitch along the entire length of the roll.

[0003] In some cases the printed decoration is implemented with several colors, using a printing unit with several plate rollers, typically one for each color. Also in this case, the colors are combined to form a decorative pattern repeated with a certain pitch along the entire length of the roll, so that in general each roll or pack of web material has the same repeated pattern or a very limited number of repeated patterns. The limit to the number of printed patterns differing from one another is due to the extension of the printing plate. In practice, the printing plate will have an extension equal to a multiple of the longitudinal dimension of the sheets into which the web material is divided by transverse perforation lines, when the article being produced is, for example, a roll of kitchen towel or toilet paper. In view of the obvious limits to the maximum diametrical dimension of the plate roller, the number of different designs that can be repeated on the article never exceeds a few units.

Objects and summary of the invention

[0004] An object of an embodiment of the invention is to provide a printing unit to decorate a continuous web material, intended to be divided into single sheets or portions, to form packs of napkins or other folded articles or, more typically, packs of material in roll form, with which decorative effects better than those currently in use can be obtained.

[0005] In substance, the invention provides for a printing unit comprising a plurality of plate rollers disposed in series along a path of the web material, so that said web material is decorated with a print obtained by the combination of designs printed by said plate rollers, wherein at least some of said plate rollers have printing plates with

printing extensions of different lengths from one another, equal to multiples of the longitudinal dimension of the sheets into which the web material is divided and each of the plates has a plurality of motifs of a length equal to said longitudinal dimension. Moreover, on each printing plate there is provided at least one series of designs different from one another and the designs of the plates of said at least two rollers differ from one another at least in part.

[0006] As will be apparent from the description of an embodiment of the invention, with a configuration of the printing unit according to the invention it is possible to obtain on the continuous web material a sequence of designs, each one for every sheet into which the web material is, or will be, divided, different from one another with a very large sequence of designs, so that inside a same pack it is possible to produce sheets all different from one another or, in any case, with patterns which are only repeated after a significant number of sheets. For example and preferably, sequences of 100 and more designs, all different from one another, can be produced, so that 100 consecutive sheets of a same pack all differ from one another. Alternatively, inside the same product, a plurality of series of sheets different from one another can be obtained, in which, for example, a single series covers 20% or more of the entire product. It is also easy to obtain more numerous sequences, up to several hundreds of different designs. This is particularly useful and interesting in the case of packs in roll form, where the single sheets can constitute a series of even very numerous designs different from one another.

[0007] According to a possible embodiment of the invention all the plates of the printing rollers have print extensions of different lengths from one another and at least some and preferably all of the rollers have different diameters, and of a value such that the circumferential extension of each plate roller is equal to a multiple of the longitudinal dimension of the single sheet. For example, there can be provided three or even four or more rollers, all with different diameters and circumferential extensions equal to different multiples of the longitudinal dimension of the single sheets.

[0008] Further advantageous features and embodiments of the invention will be described in greater detail hereunder with reference to a non-limiting embodiment of the invention.

Brief description of the drawings

[0009] The invention will be better understood by following the description and the accompanying drawing, which shows a possible non-limiting embodiment of the invention. More specifically, in the drawing:

Figure 1 shows a schematic side view of the printing unit with four colors and four plate rollers;
Figure 2 shows a planar development of the four plates mounted on the four rollers of the printing unit

in Figure 1; and

Figures 3A to 3G show the extension of a roll containing 120 sheets, each of which has a different design from the others, obtained with the printing unit in Figure 1 and the plates in Figure 2.

Detailed description of an embodiment of the invention

[0010] With initial reference to Figure 1, the printing unit, indicated as a whole with 1, has a common central counter-roller 3, around which the path of a continuous web material N extends. Four printing units 5A, 5B, 5C and 5D are arranged along the periphery of the counter-roller 3. According to an advantageous embodiment, each unit comprises schematically an inker, an anilox roller, and a plate roller. These three elements are indicated with the numbers 7, 9 and 11 followed by the letter A, B, C, D for each of the four units 5A, 5B, 5C, 5D.

[0011] In the example shown the plate rollers 11A and 11D have the same diameter, while the plate rollers 11B and 11C have diameters that differ from each other and from the rollers 11A, 11D. However, it must be understood that the plate rollers could be designed with diameters all of different dimensions from one another. The number of the printing units can also differ from the number indicated; for example two or three printing units could be provided, or also a number in excess of four.

[0012] In an embodiment in which the web material N is intended to form rolls of kitchen towel with single sheets defined between adjacent perforation lines of a length of 210 mm, the plate rollers 11A, 11C can be designed with a diameter of 401.07 mm so as to have a circumferential extension equal to 1.260 mm, i.e. six times the extension of the single sheet of web material. The plate roller 11 B can have a diameter of 267.38 mm with a circumferential extension of 840 mm, equal to four times the longitudinal extension of the sheet into which the web material is divided. Finally, the plate roller 11C can have a diameter of 334.22 mm with a circumferential extension of 1,050 mm equal to five times the length of the sheet into which the web material is divided. The circumferential extension of each plate roller 11A, 11B, 11C, 11D corresponds to the extension in length of the respective plate. Naturally, the dimensions indicated are provide purely by way of non-limiting examples.

[0013] Figure 2 shows a planar development of the plates of the four rollers 11A-11D. More specifically, A indicates the extension of the plate of the roller 11A divided into six portions, each of which has along the circumferential extension a length L equal to the length of the sheet of web material. The six designs are in fact divided into two series of three designs each, where the two series are identical. A1, A2 and A3 indicate the three designs of each series that differ from one another, which are repeated twice along the extension of the plate.

[0014] The letter B in Figure 2 indicates the extension in the plane of the plate mounted on the plate roller 11B. This plate has four designs B1, B2, B3, B4 different from

one another and different from the designs A1-A3 reproduced on the plate A.

[0015] Again with reference to Figure 2, the letter C indicates the extension in the plane of the plate mounted on the plate roller 11C. This plate has on the extension thereof five designs C1, C2, C3, C4, C5, each of a length in machine direction (i.e. circumferential) again equal to L, all different from one another and also different from the designs A1-A3, B1-B4. Finally, D indicates the extension in the plane of the plate mounted on the plate roller 11 D. This plate has a length equal to that of the plate A mounted on the roller 11A. However, six designs, all different from one another, are produced thereon and are indicated with D1, D2, D3, D4, D5, D6. As well as being different from one another, these designs are also different from the designs C1-C5, B1-B4, A1-A3.

[0016] It must be understood that the designs represented in the figures are purely schematic and in fact can take any suitable form. The figures indicate geometrical patterns provided purely for the purpose of showing how motifs different from one another can be disposed on the four plates of the four plate rollers 11A-11D.

[0017] Preferably, the color of the ink with which the four printing units 5A-5D are supplied differs from unit to unit. It is thus possible, with the four plates described above, to obtain designs formed by various combinations of the designs A1-A3, B1-B4, C1-C5 and D1-D6 in four distinct colors. However, it would also be possible for two or more printing units 5A-5D to use ink of the same color.

[0018] The result that is obtained printing the web material N with the unit 1 equipped with the plates shown in Figure 2 can be seen in Figures 3A to 3G, where the full extension of a portion of web material is visible, with a succession of 120 sheets numbered from S1 to S120, each of which is characterized by a composite pattern obtained from the combination of four distinct designs each formed by one of the four plates A, B, C, D of the plate rollers 11A-11 D. If the pack contains more than 120 sheets, the sequence of 120 designs is repeated entirely or in part, as shown in the last strip on the right in Figure 3G, where the composite designs of the sheets S1-S6 that form the first column on the left in Figure 3A are repeated.

[0019] Figures 3A-3G indicate the perforation lines P formed on the web material N by a perforator unit of a type known per se and not shown. It must be understood that when the printing unit of the present invention is produced to be positioned in a converting line for producing rolls of kitchen towel, toilet paper or the like, the various rollers of which it is composed will have a length equal to the length of the logs formed, which are then cut transversely to obtain single rolls of the desired length, equal to La in Figure 3A. In this case it must be understood that each plate A-D will have, for example, repeated axially for an adequate number of times until reaching the required axial length, the designs shown in Figure 2. Alternatively, on each plate roller the respective plates can be mounted staggered, for example by one step, with

respect to one another. Functional and aesthetic advantages are thus obtained. From the point of view of function, repetitive concentration of contact areas in an axial direction is avoided, consequently decreasing or eliminating vibrations. Aesthetically, rolls are obtained which, although formed by single sheets different from one another, are all different from the adjacent rolls at the time of transverse cutting and subsequent packaging. In this way it will be possible to obtain packs of products (for example, in the case of rolls) different from one another.

[0020] As a further alternative, the plate rollers can be covered with plates that differ from one another. In this case, the variety of subjects on each sheet and/or on each roll is multiplied by the number of annular plates mounted on each roller; obviously, also in this case, the subjects of each annular plate must be combinable with the annular plates mounted on the other plate rollers.

[0021] It would also be possible to process a web material N with the width of the finished product, in which case each plate roller will have a width substantially equal to the width of the web material and designs having the same dimension in an axial direction.

[0022] From the description above it can be seen that the number of composite designs different from one another which form the sequence of the sheets S1-S120 is equal to the product of the number of designs of the three plates B, C and D, i.e. of the three plates the extension of which has lengths equal to multiples different from one another of the length L of the single sheet and on which the sequence of designs is not repeated. The plate roller 11A on which there is disposed the plate A, having an extension equal to the plate D and a sequence of three repeated designs, is not included in calculating the number of compound or combined designs that form the sequence of designs on the sheets S1-S120.

[0023] If, instead of the plate A that repeats the same sequence of three designs twice and has an extension equal to the plate D, a plate with an extension having a length equal to 7 times the length L and different designs with respect to the designs of the plates B, C and D is used, the overall number of designs different from one another obtained on the finished product before the first design of the series appears again in the print sequence is equal to the product of the length of each plate expressed as multiple of the base length L. In the example, if the plate A were replaced with a plate of circumferential length equal to 7xL with designs all different from one another and different from the designs B, C and D, the sequence of different designs would contain a number equal to $4 \times 5 \times 6 \times 7 = 840$ designs.

[0024] It is understood that the drawing only shows an example provided by way of a practical arrangement of the invention, and that said invention can vary in forms and arrangement without however departing from the scope of the concept underlying the invention. Any reference numbers in the appended claims are provided to facilitate reading of the claims with reference to the description and to the drawing, and do not limit the scope

of protection represented by the claims.

Claims

1. A printing unit to decorate a continuous web material, divided into plurality of sheets having a longitudinal dimension along the extension of the web material, comprising a plurality of plate rollers disposed in series along a path of the web material, so that said web material is decorated with a print obtained by the combination of designs printed by said plate rollers, characterized in that:
 - at least some of said plate rollers have printing plates with printing extensions of different lengths from one another, equal to multiples of said longitudinal dimension, each of the plates having a plurality of designs of a length equal to said longitudinal dimension;
 - on each printing plate there is provided at least one series of designs different from one another;
 - and the designs of the plates of said at least two rollers differ from one another at least in part.
2. Printing unit as claimed in claim 1, wherein the designs of each printing plate of said plate rollers are different from the designs of all the other printing plates of the other plate rollers.
3. Printing unit as claimed in claim 1 or 2, wherein each plate roller has plates with designs all different from one another and not repeated.
4. Printing unit as claimed in claim 1 or 2, wherein one of said plate rollers has a plate on which there is repeated at least twice a series of designs different from one another and different from the designs of the other plate rollers.
5. Printing unit as claimed in one or more of the preceding claims, wherein the plates of all the plate rollers of the printing unit have printing extensions of different lengths from one another.
6. Printing unit as claimed in one or more of the preceding claims, comprising at least three plate rollers of different diameters, the printing plates of said three rollers having printing lengths different from one another and not multiples of one another.
7. Printing unit as claimed in one or more of the preceding claims, wherein said plate rollers cooperate with a common central counter-roller.
8. Printing roller as claimed in one or more of the preceding claims, wherein at least some of said plate rollers-print with different colors from one another.

9. Printing unit as claimed in claim 8, wherein all the plate rollers print with different colors from one another.
10. A paper converting line, comprising a printing unit as claimed in one or more of the preceding claims, and at least one machine for converting of the printed web material downstream of said printing unit. 5
11. Conversion line as claimed in claim 10, comprising downstream of said printing unit a perforator which divides said web material into a plurality of sheets detachable along transverse perforation lines, and a rewinding machine that winds said web material into rolls. 10 15
12. A pack of web material comprising a multiple set of sheets, wherein at least 20% of the sheets of said set have printed designs different from one another. 20
13. Pack as claimed in claim 12, wherein at least 50% of the sheets of said set have printed designs different from one another.
14. Pack as claimed in claim 12 or 13, wherein said set comprises at least one hundred sheets. 25
15. Pack as claimed in claim 12, 13 or 14, wherein said pack is a roll of tissue paper and said sheets are portions detachable along perforation lines of the web material wound in a roll. 30
16. Pack as claimed in claim 12, 13, 14 or 15, wherein said pack is composed of a plurality of rolls of tissue paper, each roll being formed by detachable portions different from one another. 35
17. Pack as claimed in claim 16, wherein each roll has externally at least one printed design different from the printed designs of the other rolls contained in said pack. 40
18. Pack as claimed in claim 12, 13 or 14, wherein said pack is a packet of single folded sheets, such as napkins or the like. 45
19. Pack as claimed in one or more of claims 12 to 18, wherein all the sheets of said pack have different designs from one another. 50

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Fig. 1

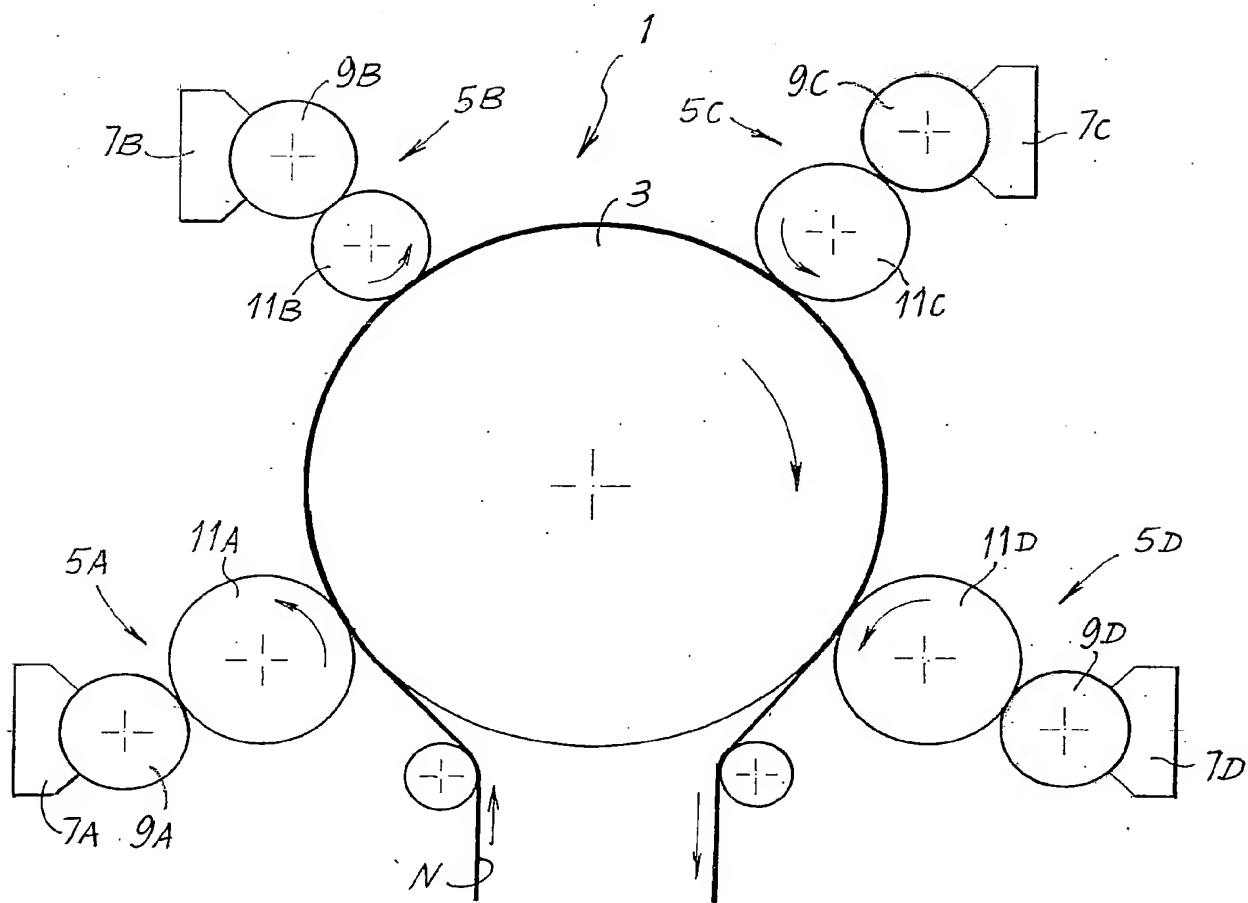


Fig. 2

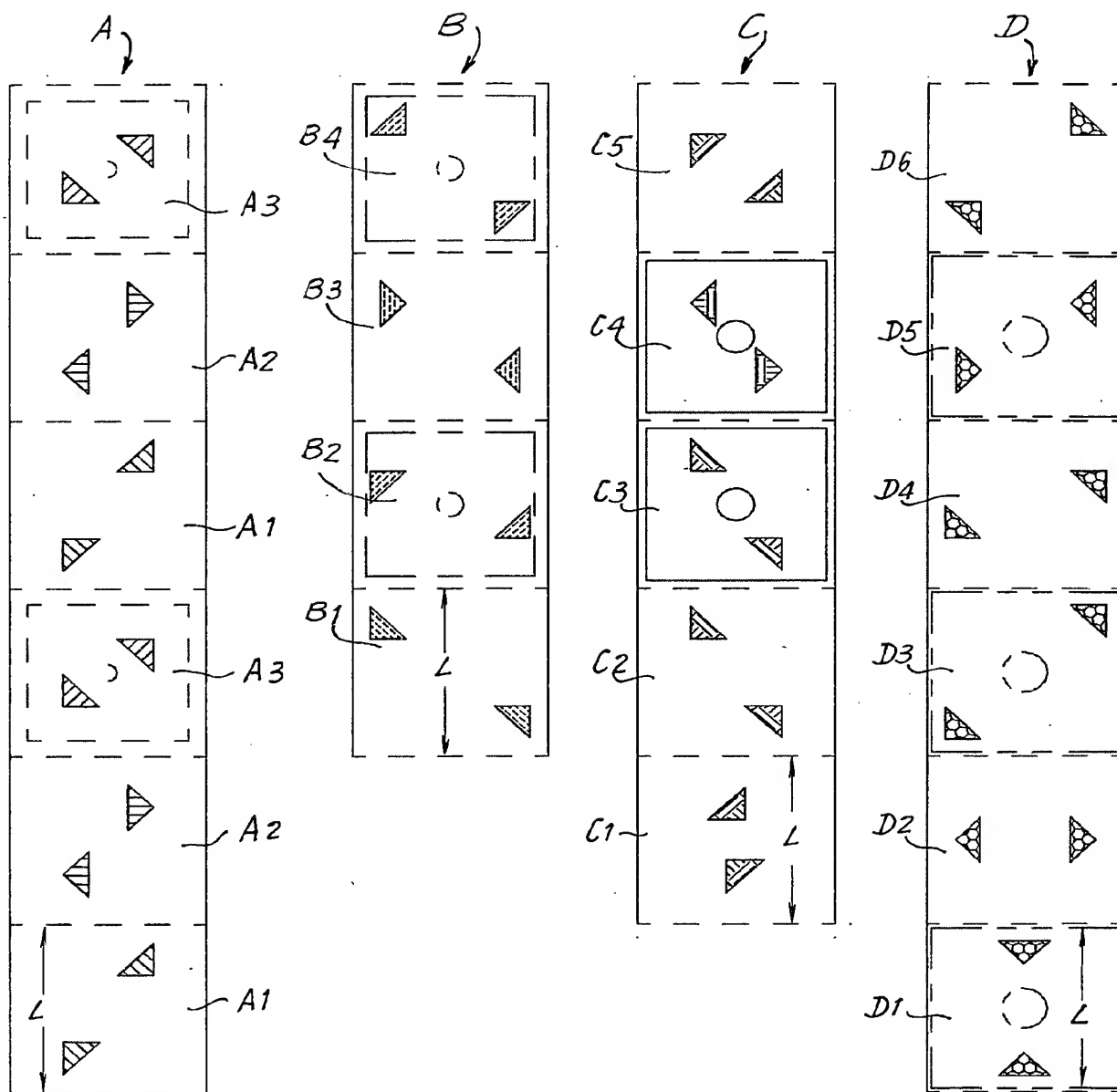


Fig. 3A

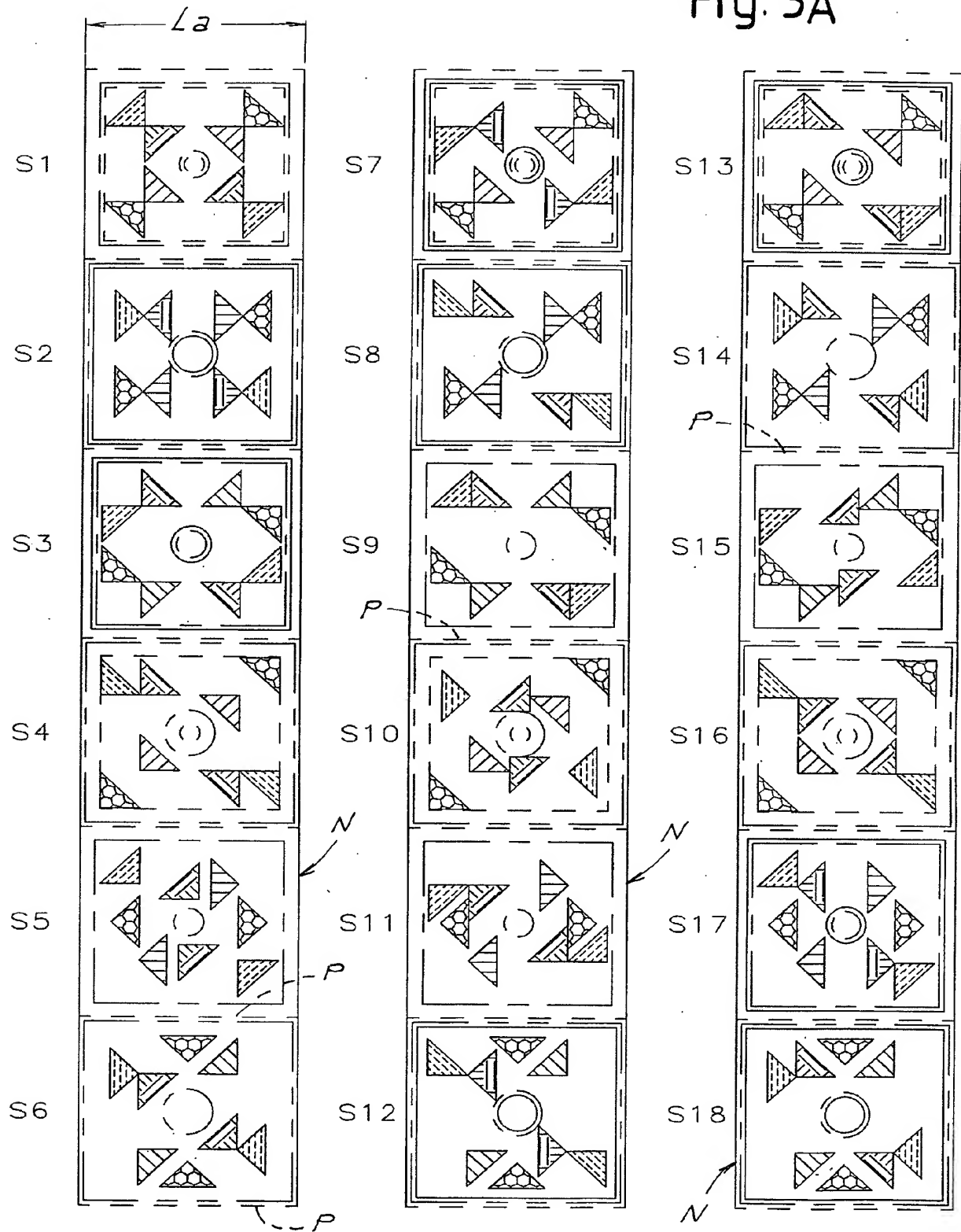


Fig. 3B

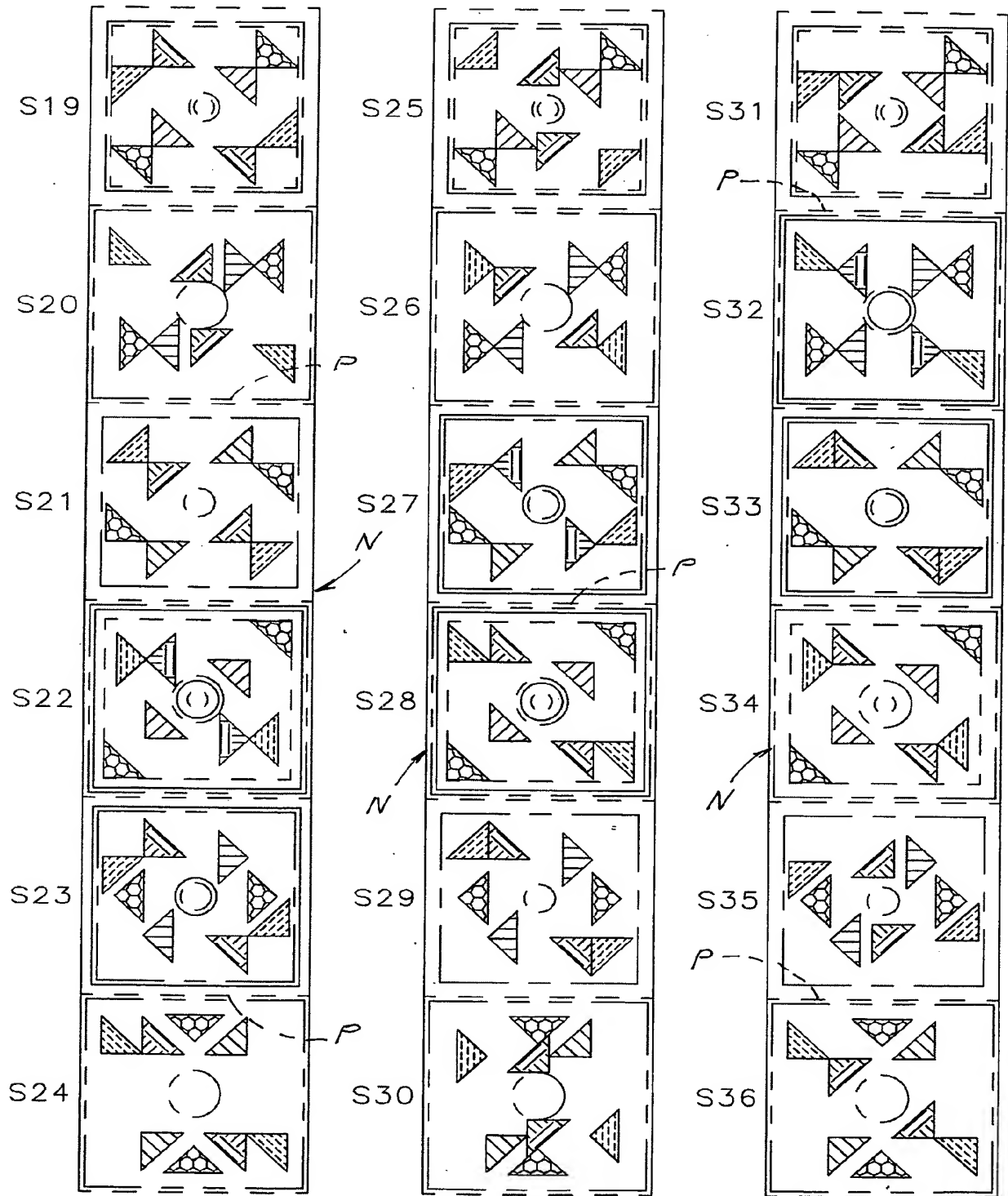


Fig. 3C

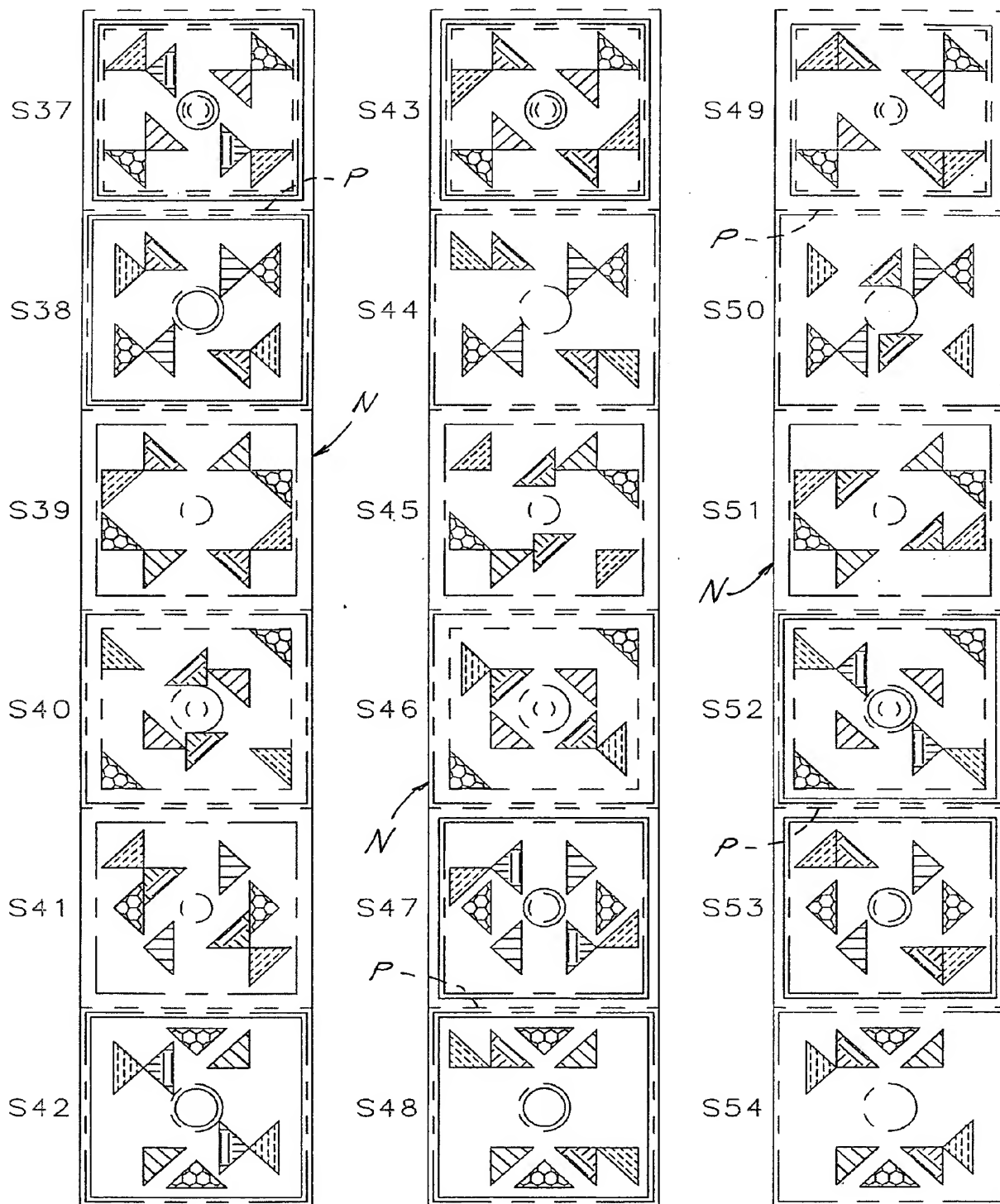


Fig.3D

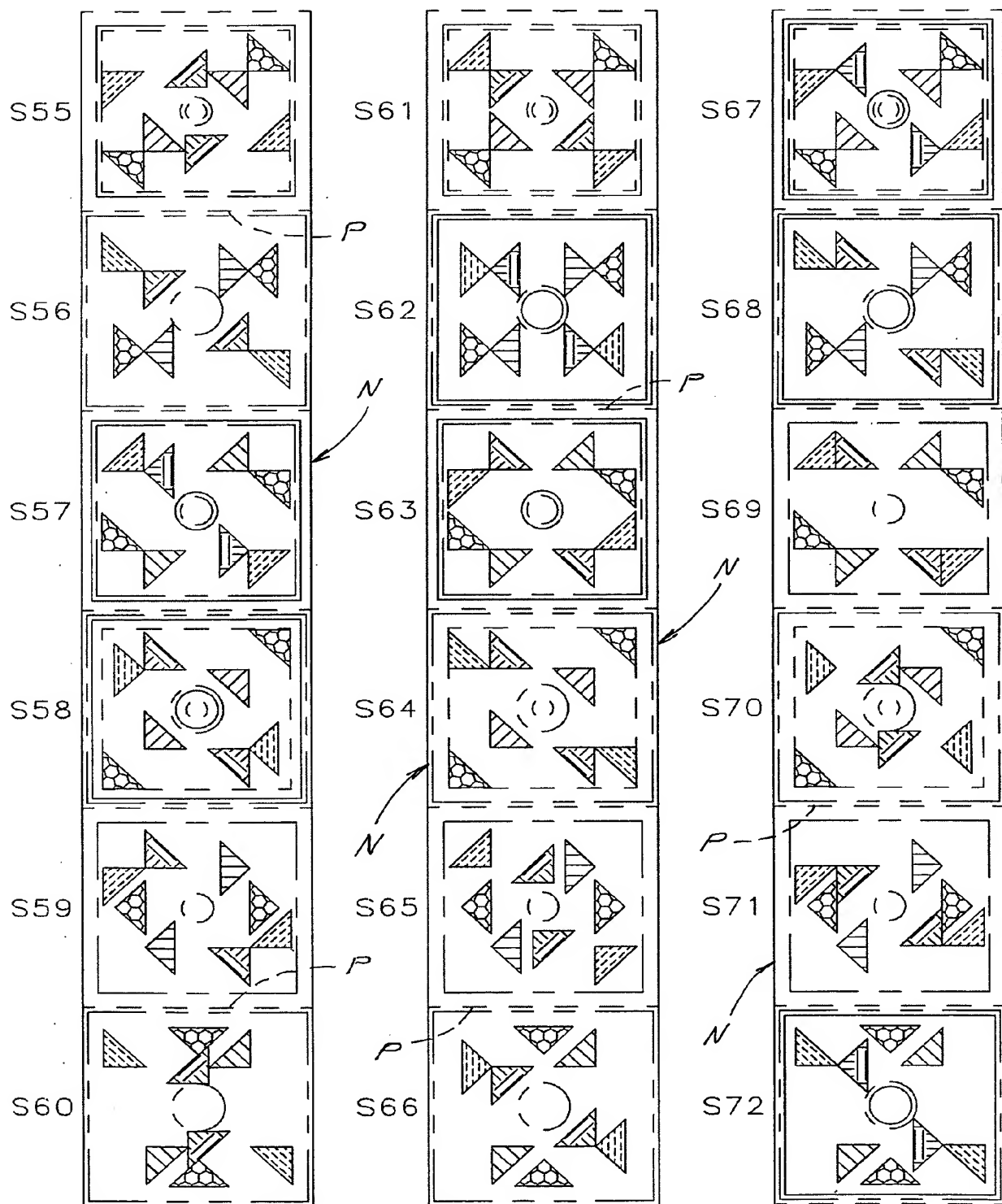


Fig. 3E

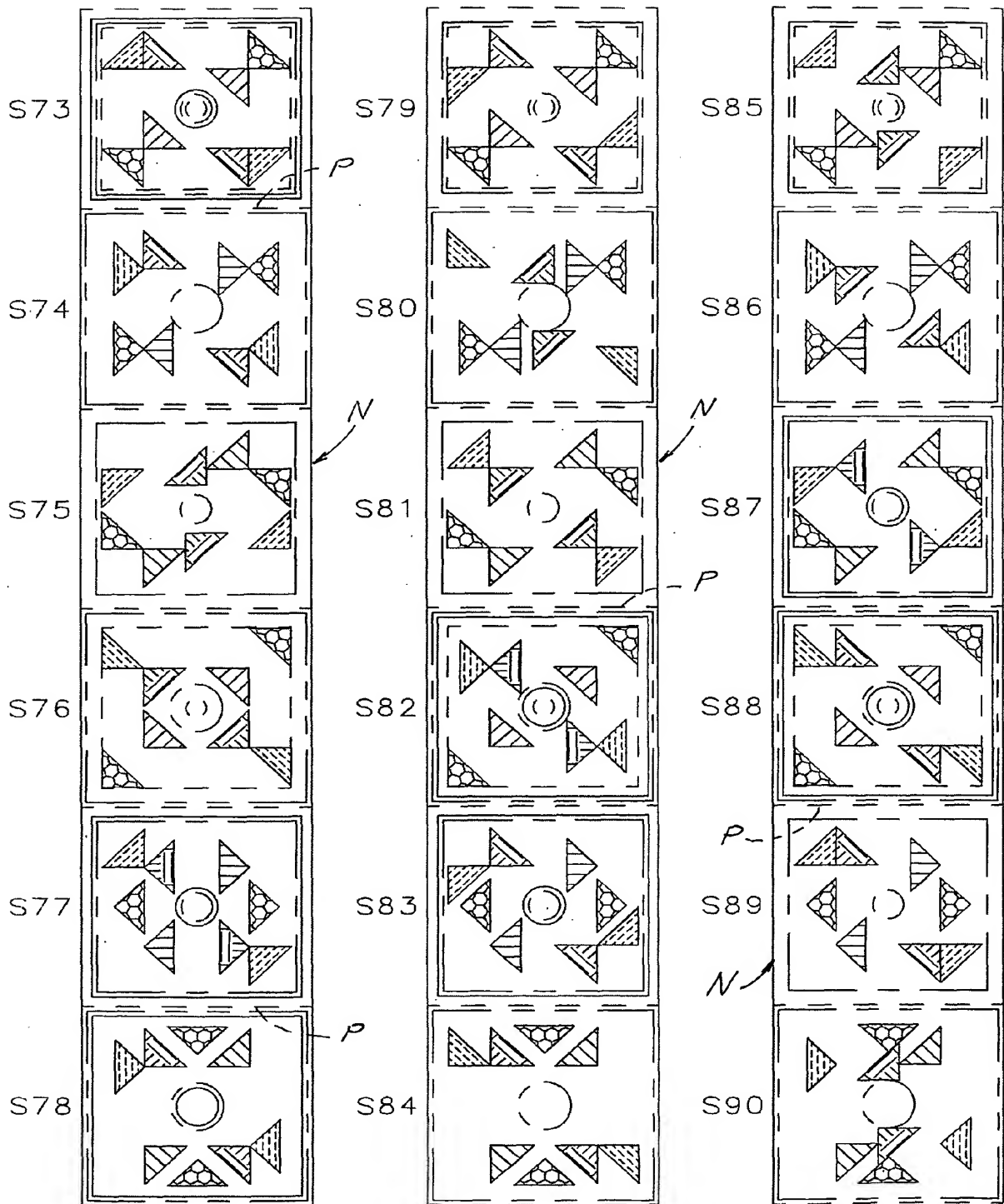


Fig. 3F

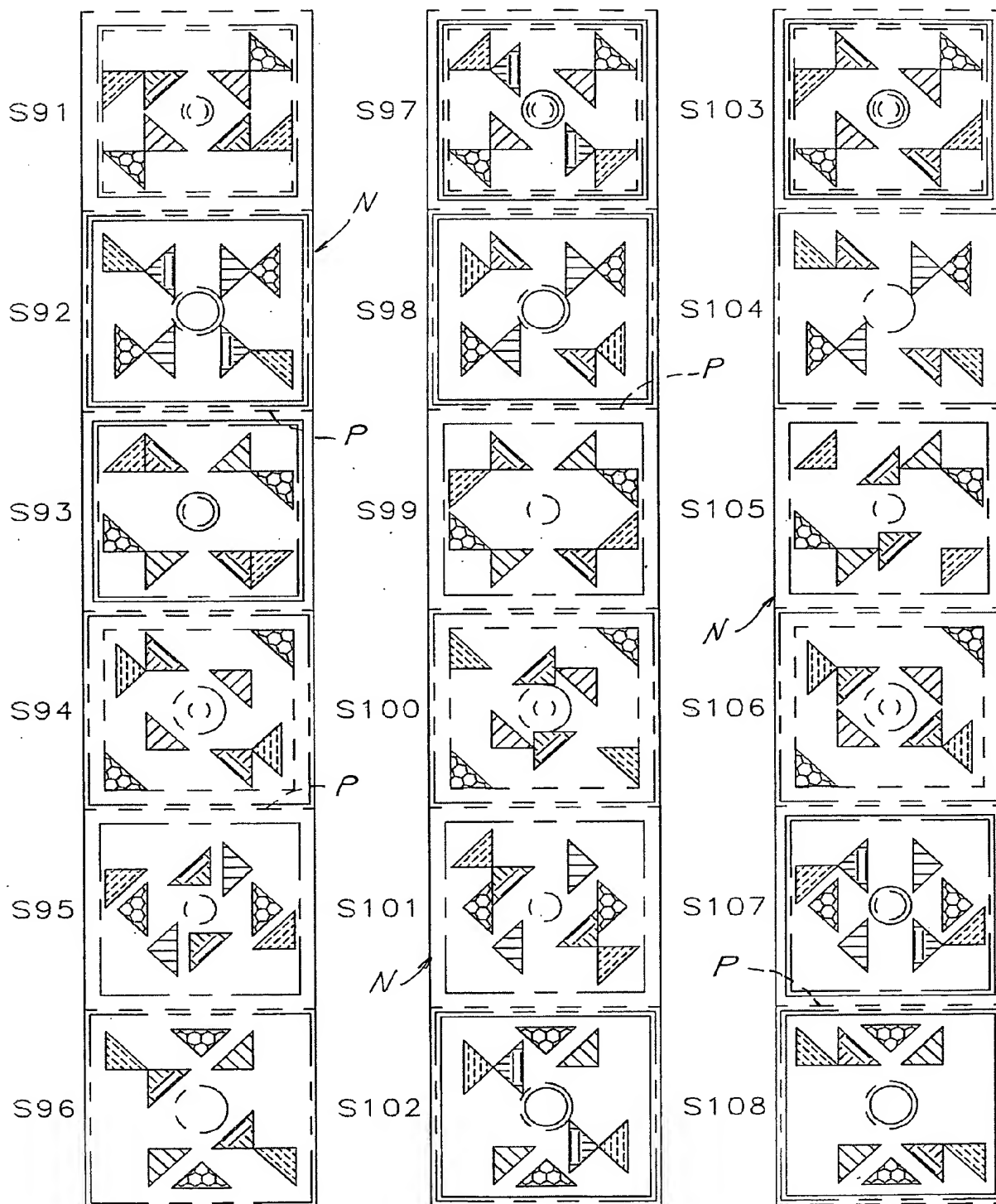


Fig. 3G

